National Weather Service Des Moines' Newsletter

THE WEATHER WHISPER

Fall/Winter 2013/2014

Science and Operations Officer Karl Jungbluth Retires

In November, the National Weather Service in Des Moines said good-bye to Science and Operations Officer (SOO) Karl Jungbluth as he retired from over 30 years of government service. As the SOO, Karl has been leading the science and training program at the Des Moines office for over 19 years. Karl began his National Weather Service career as a temporary Summer Trainee at the Forecast Office in Anchorage, Alaska in 1980. After earning his Bachelor's and Master's degrees in Meteorology from the University of Wisconsin-Madison, he worked his way up to a Forecaster position in the Anchorage office.

In 1988, Karl made the great jump from Alaska to the National Severe Storms Forecast Center in Kansas City as a Mesoscale Meteorologist. While in Kansas City, he served the continental U.S. by writing satellite and mesoscale discussions, and provided status updates on Severe Thunderstorm and Tornado Watches.

The final move of Karl's career came in 1994 as the National Weather Service Modernization created the new position of SOO at Warning and Forecast Offices across the country. Karl has enjoyed working with his local staff and with meteorologists at Iowa State University and across the country to introduce new technology and upgraded forecast techniques- all to serve the people of Iowa with the best possible forecasts and warnings.

In retirement, Karl plans to spend more time outdoors bird watching, gardening and with various landscape projects.

Thank you for your service Karl!
We wish you all the best in your retirement!

IN THIS ISSUE

Weather-Ready Nation: Saving Lives and Livelihoods

Editors

Ken Podrazik
Aubry Bhattarai

Cover photo courtesy of Ken Podrazik

Winter Weather Preparedness

by Aubry Bhattarai, Journey Forecaster

Each year, exposure to cold, vehicle accidents caused by wintry roads, and fires caused by the improper use of heaters injure and kill hundreds of people in America. Add these to other winter weather hazards and you have a significant threat to human health and safety.

Winter storms can range from a moderate snow over a few hours to a blizzard with blinding, wind-driven snow that lasts for several days. Some winter storms are large enough to affect several states, while others affect only a single community.

What to listen for:

- **Winter Weather Advisory:** Accumulations of snow, freezing rain and/or sleet which, if caution is not exercised, could lead to life-threatening situations.
- **Winter Storm Watch:** Winter storm conditions are possible in the next 12 to 48 hours.
- **Winter Storm Warning:** Issued when hazardous winter weather in the form of heavy snow, heavy freezing rain and/or heavy sleet is occurring or expected to occur within the next 36 hours.
- **Blizzard Watch:** Blizzard conditions are possible in the next 12 to 48 hours.
- **Blizzard Warning:** Combination of sustained wind or frequent gusts 35mph or greater and visibility less than ¼ mile in snow and/or blowing snow expected to last at least 3 hours. Expected to occur within the next 36 hours.
- **Wind Chill Advisory:** Wind chill values between -20°F and -29°F are expected to occur within the next 36 hours.
- **Wind Chill Watch:** Wind chill values of -30°F or lower are possible within the next 12 to 48 hours.

For More Information on Wither Weather in Iowa, Visit Our Preparedness Webpage!

NWS Windchill Chart

Temperature (°F)

Wind (mph) \ Calm	40	35	30	25	20	15	10	5	0	-5	-10	-15	-20	-25	-30	-35	-40	-45
5	36	31	25	19	13	7	1	-5	-11	-16	-22	-28	-34	-40	-46	-52	-57	-63
10	34	27	21	15	9	3	-4	-10	-16	-22	-28	-35	-41	-47	-53	-59	-66	-72
15	32	25	19	13	6	0	-7	-13	-19	-26	-32	-39	-45	-51	-58	-64	-71	-77
20	30	24	17	11	4	-2	-9	-15	-22	-29	-35	-42	-48	-55	-61	-68	-74	-81
25	29	23	16	9	3	-4	-11	-17	-24	-31	-37	-44	-51	-58	-64	-71	-78	-84
30	28	22	15	8	1	-5	-12	-19	-26	-33	-39	-46	-53	-60	-67	-73	-80	-87
35	28	21	14	7	0	-7	-14	-21	-27	-34	-41	-48	-55	-62	-69	-76	-82	-89
40	27	20	13	6	-1	-8	-15	-22	-29	-36	-43	-50	-57	-64	-71	-78	-84	-91
45	26	19	12	5	-2	-9	-16	-23	-30	-37	-44	-51	-58	-65	-72	-79	-86	-93
50	26	19	12	4	-3	-10	-17	-24	-31	-38	-45	-52	-60	-67	-74	-81	-88	-95
55	25	18	11	4	-3	-11	-18	-25	-32	-39	-46	-54	-61	-68	-75	-82	-89	-97
60	25	17	10	3	-4	-11	-19	-26	-33	-40	-48	-55	-62	-69	-76	-84	-91	-98

Frostbite Times: 30 minutes, 10 minutes, 5 minutes

Wind Chill (°F) = $35.74 + 0.6215T - 35.75(V^{0.16}) + 0.4275T(V^{0.16})$

Where, T= Air Temperature (°F) V= Wind Speed (mph)

Effective 11/01/01

- **Wind Chill Warning:** Wind chill values of -30°F or lower are expected to occur within the next 36 hours.
- **Freezing Rain Advisory:** Accrual of less than ¼ inch of ice is expected due to freezing rain within the next 36 hours.
- **Ice Storm Warning:** Accrual of ¼ to one inch or more of ice is expected due to freezing rain within the next 36 hours.

Know before you go:

- ⇒ Have your vehicle winterized before the winter storm season.
- ⇒ Keep the gas tank full so you are ready in case of an emergency and to prevent the gas line from freezing.
- ⇒ Take a fully charged cell phone or two-way radio with you.
- ⇒ Plan to travel during the daylight and, if possible, take at least one other person with you.
- ⇒ Let someone know your route and when you expect to arrive.
- ⇒ Be sure to check the weather and road conditions before leaving.
- ⇒ Avoid travel after a winter storm as roads may still be blocked or snow may still be blowing, reducing visibilities.

Communities Renew StormReady® Status

by Aubry Bhattarai, Journey Forecaster

Recently, both Polk County and Marshall County completed full renewals of their StormReady® status. In addition, Iowa State University also completed a renewal of its StormReady® status. These communities completed a set of rigorous criteria necessary to earn the distinction of being StormReady®. Part of the criteria includes promoting the importance of public readiness through community seminars and developing a formal hazardous weather plan, which includes training severe weather spotters and holding emergency exercises. Polk County initially became StormReady® in the fall of 2001, Marshall County initially became StromReady® in 20007, and Iowa State University first become StormReady® in the fall of 2004.

StormReady® is a voluntary program that provides communities and universities with clear-cut advice from a partnership between local National Weather Service forecast offices and state and local emergency managers. The National Weather Service congratulates Polk and Marshall Counties and Iowa State University on maintaining their StormReady® status!

Ottumwa Job Corps Recognized as a StormReady Supporter

by Jeff Johnson, Warning Coordination Meteorologist

Officials from NOAA's National Weather Service recognized the Ottumwa Job Corps on April 2, 2013 as a StormReady® Supporter. The Ottumwa Job Corps joins six other Iowa agencies or businesses as a StormReady® Supporter. The Ottumwa Job Corps in also the first Job Corps Center to become a StormReady® Supporter in the nation.

"StormReady® Supporters take a new, proactive approach to improving hazardous weather operations, response and preparedness," said Jeff Johnson, Warning Coordination Meteorologist (WCM) at the National Weather Service Forecast Office in Des Moines, IA. The program is voluntary and provides businesses and groups with clear-cut advice from a partnership between local National Weather Service forecast offices and state and local emergency managers. To be recognized as a StormReady® Supporter, a business or group must:

- Establish a 24-hour warning point and emergency operations center
- Have more than one way to receive severe weather forecasts and warnings and to alert the public
- Create a system that monitors local weather conditions
- Promote the importance of public readiness through training and seminars
- Develop a formal hazardous weather plan, which includes specific instructions and protocols in responding to different severe weather hazards.

Des Moines forecast office WCM Jeff Johnson presented Center Safety Officer Christopher Fisher with a framed StormReady® Supporter certificate at the Ottumwa Spotter Training Class on April 2, 2013.

NOAA and the National Weather Service are dedicated to enhancing economic security and national safety through the prediction and research of weather and climate-related events and information service delivery for transportation, and by providing environmental stewardship of the nation's coastal and marine resources.

Chris Fisher, Ottumwa Job Corps receives the StormReady Supporter certification from Jeff Johnson, National Weather Service. Also pictured: Job Corps Officer Grideon VanLoon, Wapello County Emergency Manager Josh Stevens and Ken Podrazik, National Weather Service.

Where do River Level and Streamflow Data Come From? - Part 1

by Jeff Zogg, Senior Hydrologist

Introduction

Floods are among the most frequent and costly natural disasters in terms of human hardship and economic loss. From a national perspective, over the past 30 years floods have claimed an average of 94 lives yearly. In addition, the economic impacts of floods are growing. The average annual inflation-adjusted flood losses have risen in each of the past three decades—from \$4.7 billion for 1981 through 1990, to \$7.9 billion for 1991 through 2000 and to \$10.2 billion for 2001 through 2010. Iowa has experienced its share of floods and flood losses. Our state ranks number two in the United States for flood-related losses over the long term. In addition, over three-fourths of all Presidential disaster declarations involving Iowa have been either fully or partially due to flooding.

The National Weather Service (NWS) places a high priority on timely and accurate flood warnings and forecasts in Iowa. These warnings and forecasts can help people take measures to mitigate flood-related losses. Typically, the NWS can provide the most lead time and highest accuracy in warnings and forecasts involving river flooding. In order to provide the best possible river flood warnings and forecasts, however, the NWS must know what the river is doing in real-time before a confident warning or forecast can be provided. In addition, long-term, accurate data records are needed so that the NWS can calibrate its river forecast models.

In Iowa, the NWS owns and maintains relatively few real-time streamgages so that it can instead focus its efforts and resources on flood warnings and

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2013 Cooperative Observer Length of Service Awards

by Brad Fillbach, Hydro-Meteorological Technician/Cooperative Program Manager

John Esdohr (left) receives the 50 year institutional award for Coon Rapids Municipal Utilities in Coon Rapids. Jeff Johnson (right), WCM, WFO Des Moines, presents the award.

Justin Kester (right) receives the 50 year institutional award for Lake Mills Municipal Power & Light in Lake Mills. Brad Fillbach (left), HMT, WFO Des Moines presents the award.

Rex Kelley of Davis City receives his 35 year length of service award. Jeff Johnson, WCM, WFO Des Moines, made the presentation.

Winston Sayre of Indianola receives his 25 year length of service award. Rob DeRoy, DAPM, WFO Des Moines, made the presentation.

Dr. Galen Eiben of Shell Rock, Iowa receives his 35 year length of service award. Brad Fillbach, HMT, WFO Des Moines, made the presentation.

Mike Fiscus of Ames receives his 10 year length of service award. Rob DeRoy, DAPM, WFO Des Moines, made the presentation.

Cooperative Observer Length of Service Awards Continued

Dewey Flaherty (right) receives the 25 year institutional award for the Pocahontas Waste Water Treatment Plant in Pocahontas. Rob DeRoy (left) DAPM, WFO Des Moines, IA presents the award.

NWS Des Moines Hosts a Weather Enterprise Open House

By Ken Podrazik, Journey Forecaster

The National Weather Service in Des Moines hosted an open house on Saturday, September 21, 2013. It had been 5 years since the last open house at the weather forecast office (WFO) and the staff decided it was time for another one. The difference in this year's open house was the WFO invited their local partners to join the festivities. With a 'Weather Enterprise' theme, the local partners each displayed a booth about their relationship with the NWS, their role in weather safety, and the significance of decision support. Participating partners included: U.S. Geological Survey, U.S. Army Corps of Engineers, Iowa Homeland Security and Emergency Management, Polk County Emergency Management, Iowa Environmental Mesonet, Mid-Iowa Skywarn, Safeguard Iowa, ABC5 (WOI) Weather, KCCI Weather, WHO Weather, Iowa state climatologist Harry Hillaker, and local chapters of the National Weather Association and American Meteorological Society that consisted of meteorology students from Iowa State University.

The NWS Des Moines staffed three main stations inside the building. At one station, the Weather Event Simulator was utilized to interrogate storms, create warning polygons, and define Impact Based Warnings. At a second station, a meteorologist described the multiple features in AWIPS and the forecast process. The third station was dedicated solely to electronics within the NWS. In the parking lot, the NWS staffed a booth with handouts, kid's temporary tattoos, word searches, posters, Timmy the Twister, Rate the Tornado Game and more. In addition, the NWS hosted a food drive for the Food Pantries of Central Iowa. Other staff members were available to answer questions and interact with the visitors. The open house attendance was estimated at around 600 visitors.

Figure Caption here: Group photo of the NWS employees and partners after the open house (left). Kevin Skow shows some visitors how the NWS creates severe thunderstorm warning polygons (top). Photo of the NWS Des Moines parking lot and the multiple booths (top middle). Picture of the NWS booth (bottom).

River Level and Streamflow Data

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forecasts. Thus the NWS relies on various partners to measure river levels and streamflows and provide that data in real-time. From a statewide perspective, the largest NWS streamgaging partners are the U.S. Geological Survey, the U.S. Army Corps of Engineers and the Iowa Flood Center. Other partners include several local communities. This article will focus on the U.S. Geological Survey. Articles in future newsletters will focus on other partners.

U.S. Geological Survey

From a national perspective, the U.S. Geological Survey (USGS) is the principal source of real-time river level and streamflow data. The USGS is part of the U.S. Department of the Interior. Chartered in 1879 by the U.S. Congress, the USGS is our Nation's leading earth science information agency. As with the NWS, the most important part of the USGS mission is protection of life and property. To accomplish this task the USGS collects and provides practical information about our Nation's rivers and streams. This information is also used in the design and operation of engineering projects such as dams and levees. The USGS streamgaging network is the primary source of this information.

The USGS operates and maintains more than 85 percent of our Nation's streamgaging stations including 98 percent of those that are used by the NWS for real-time river forecasting. The USGS is also the principal source of real-time river level and streamflow data in Iowa. The USGS presently operates nearly 200 real-time streamgages and nearly 20 real-time rain gages in our state.

The USGS has a staff of approximately 25 full-time and part-time professionals in Iowa who are dedicated to the highest quality streamgaging data and service possible. Many of them are located at the USGS Iowa Water Science Center in Iowa City. Additional staff is located at the USGS field offices in Iowa City, Fort Dodge and Council Bluffs.

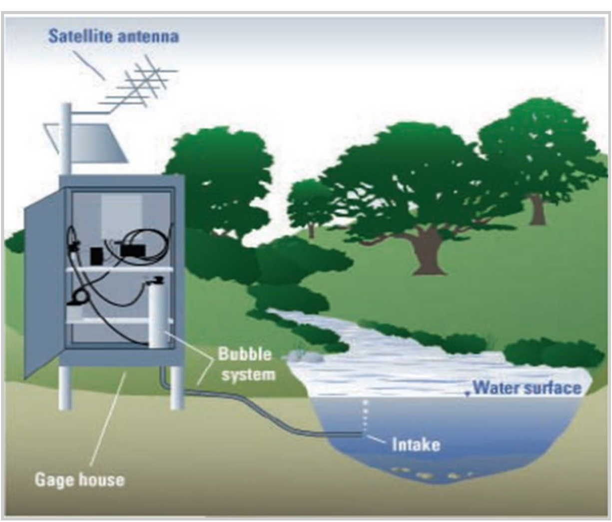
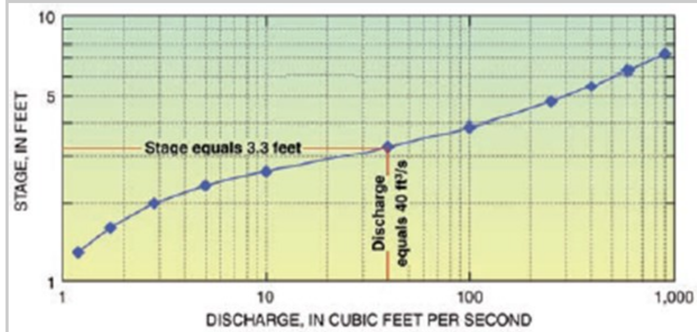


Diagram of a typical streamgage installation with equipment used to measure stage. Credit: U.S. Geological Survey.



Example of a typical rating curve. Credit: U.S. Geological Survey

River Data Collected

The two most fundamental items of hydrologic information about a river are river level and streamflow. Those two parameters are also known as stage and discharge respectively.

River stage is a measure of the height of the water above a reference elevation. Stage is usually expressed in units of feet. Discharge is the volume of water which flows past a point on the river for a given period of time. Discharge is usually expressed in units of cubic feet per second. Both stage and discharge are measured at a location on the river called a streamgaging station.

All of the USGS streamgaging stations in Iowa automatically measure stage and compute discharge at a 15-minute interval and report the data in real-time to the NWS and on public Web pages. The real-time reporting equipment allows for the river stage to be continuously monitored from afar and reported to an accuracy of 1/8 of an inch. Linking battery-powered stage recorders with satellite radios enables transmission of stage data to the NWS and public Web sites even when the power goes out due to floods and other kinds of severe weather. Thus, the NWS and other users of river information know the river stages at remote sites and how fast the water is rising or falling.

Although both stage and discharge are important elements, the NWS river forecast models work with streamflow not stage. The model output is in streamflow but is converted to stage to help facilitate easier understanding by NWS partners and users. The model input must also be streamflow. Since it is not feasible for USGS staff to continuously be on-site, measuring and reporting discharge at all of their streamgaging locations in Iowa 24/7, there must be a way to relate stage and discharge. The rating curve accomplishes this task. In other words, the rating curve is a graphical representation that relates discharge to stage and allows the NWS and other users to determine the streamflow based on reported stage.

The USGS develops and maintains rating curves for many of its streamgages in Iowa by measuring discharge. Accurate discharge information requires direct, on-site measurements of the streamflow by

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River Level and Streamflow Data

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USGS staff using sophisticated equipment which has been thoroughly tested by USGS research scientists. The USGS then uses this data to develop rating curves. Each USGS streamgaging station typically has just one rating curve in effect at any given time. The stage-discharge relation—and thus the rating curve—often changes over time for many USGS streamgaging stations however. Thus, the USGS must make additional on-site visits at regular intervals, typically every six weeks.

During each site visit, USGS staff verifies stage recorders are working properly by comparing readings to independent stage sensor that are frequently surveyed to confirm stage readings. Direct measurements of discharge are also made during each site visit to ensure the rating curve remains accurate. Any necessary adjustments to the stage-discharge relation, either temporary or permanent, are made by the USGS and reflected on public Web pages and relayed to the NWS. The USGS will also make site-visits during floods to make additional streamflow measurements during these critical river levels. Since NWS river forecast models depend on rating curves to convert between stage and streamflow, an inaccurate rating curve may led to inaccurate NWS river stage forecasts.

Funding Resources

Although the USGS maintains the streamgages that it owns—and maintains rating curves at many of them—not all of the necessary funding comes from Federal Government funding appropriations to the USGS. Instead, cooperative funding agreements exist for many of its gages. In these situations, non-USGS entities help fund USGS streamgage measurement and maintenance activities. These non-USGS entities include other Federal, state and local government partner agencies as well as private industry. From the contribution of non-USGS funding resources the USGS is able to maintain its relatively large streamgage network.

USGS staff making a discharge measurement on the West Fork Cedar River near Finchford, IA. Credit: U.S. Geological Survey.

USGS-NWS Partnership

The USGS is a valuable partner of the NWS. The USGS works diligently to provide the most current and accurate stage and discharge data to the NWS, especially during floods. The USGS furnishes continuous information on river stage and discharge and provides rating curve revisions to the NWS as soon as they become available. The USGS may also make special, unscheduled discharge measurements as requested by the NWS. Such measurements are sometimes necessary to help facilitate accurate flood forecasts. If streamgages malfunction then the USGS will quickly troubleshoot and repair them. In addition, the USGS may install temporary gages to help gather valuable stage and discharge data—either in a previously ungaged location or as a replacement for a permanent streamgage which may be threatened by a flood. The USGS may do any of these special activities whenever needed—including during the night and in inclement, stormy weather—to help the NWS provide the most accurate and timely flood warnings and forecasts possible.

The NWS and USGS are in frequent communication during both floods and normal streamflow conditions. This communication helps ensure that the most up-to-date and accurate data are available for NWS river forecast models and users of this information.

The Future

The NWS-USGS partnership is expected to continue well into the future. The demand for NWS river flood warning and forecast services is expected to continue growing due to expanding population, urbanization and economic growth. Although new radar technologies and computer visualization techniques hold significant promise for improving the timeliness and accuracy of river flood warnings and forecasts, real-time, ground-based river measurements will continue to be needed. The need for real-time river measurement and subsequent NWS river forecast model adjustment is more than a scientific quest for accuracy—it is critically important to maintain model accuracy to help minimize flood-related losses. The detail and timeliness of the required data can be provided only by on-site streamgaging stations.

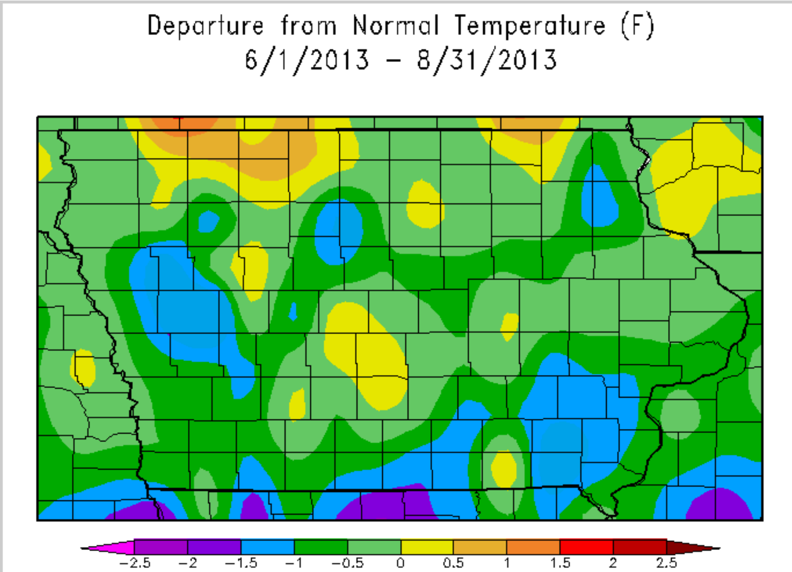
Thank you to Jon Nania, Hydrologist with the USGS Iowa Water Science Center for his contributions to this article.

Resources

NWS Hydrologic Partners: http://water.weather.gov/ahps/partners/nws_partners.php.
NWS-USGS Partnership Fact Sheet: http://water.usgs.gov/wid/FS_209-95/mason-weiger.html.
Iowa USGS Water Science Center: http://ia.water.usgs.gov/.
USGS Streamgage Fact Sheet: http://pubs.usgs.gov/fs/2011/3001/pdf/fs2011-3001.pdf.
USGS WaterWatch: http://waterwatch.usgs.gov/.

Summary and Early Fall Weather Review

By Craig Cogil, Lead Forecaster



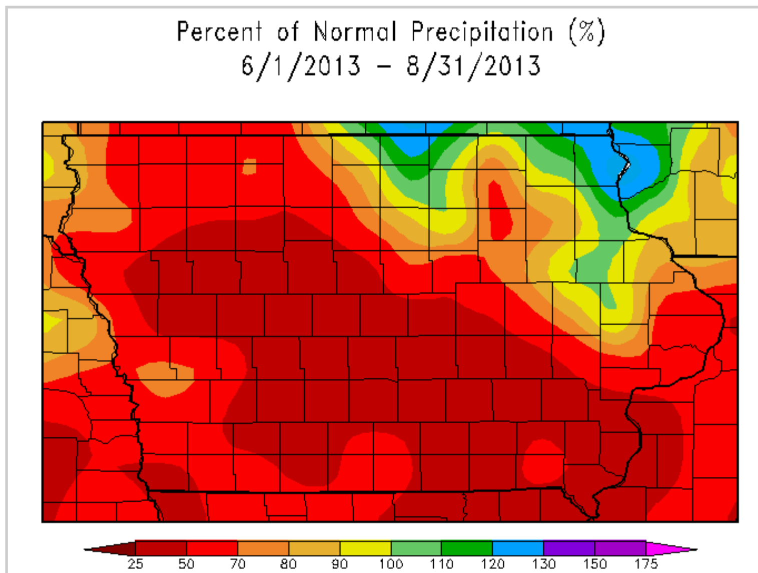
Summer temperature departure across Iowa: generally slightly cooler than normal.

Temperatures:

Compared to the summer of 2012, this past summer was much more tolerable as far as temperatures are concerned. In fact, readings were below normal for June and July with the hottest period of summer coming during the month of August. In fact, the last week of August saw intense heat across the state with temperatures well into the 90s with a few locations in excess of 100 degrees. The high heat continued into early September with 90s persisting through the first 10 days of the month. However, temperatures cooled some by the middle of the month with more normal readings from later in September through October.

Precipitation:

While rainfall was close to normal during June, the precipitation shut off by late in the month with much drier than normal conditions in July through August. Precipitation for the summer was once again 50% of normal for large portions of the state, especially central and southern sections of Iowa. Only the far northeast corner escaped the dry conditions with rainfall much closer to normal. The dry conditions once again led to widespread moderate to severe drought conditions over much of Iowa with impacts on field crops as well as decreased flow on rivers and streams. However, one of the benefits of the drier conditions was the lack of overall severe weather during the summer months. Rainfall did increase in September and October, but it was not sufficient to end drought conditions, especially across southern Iowa.



Summer rainfall departures: much of the southwest two-thirds of Iowa was well below normal.

Iowa Statewide Averages and Rankings for Temperature and Precipitation

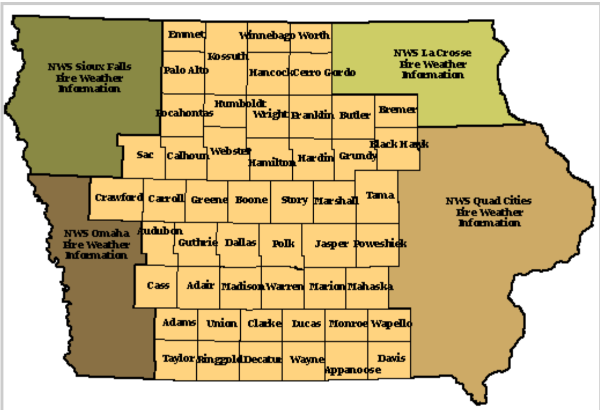
by Craig Cogil, Lead Forecaster

Month	Temperature	Departure from Normal	Rainfall	Departure from Normal	Temperature Ranking	Precipitation Ranking
June 2013	69.0°F	-0.7°F	5.14″	+0.12″	55th Coolest	55th Wettest
July 2013	72.2°F	-1.1°F	1.77″	-2.73″	31st Coolest	9th Driest
Aug 2013	72.1°F	+0.6°F	1.57″	-2.63″	65th Warmest	7th Driest
Sept 2013	66.9°F	+3.7°F	1.98″	-1.40″	19th Warmest	25th Driest
Oct 2013	50.6°F	-0.2°F	2.79″	+0.18″	56th Coolest	54th Wettest
Summer 2013	71.2°F	-0.4°F	8.48″	-5.23″	47th Coolest	15th Driest

All values are preliminary. Rankings are based upon 141 years of records. Summer months include June through August.

Climatological Data for July through October 2013							
Location	**Month**	**Average Temp**	**Departure**	**Highest**	**Lowest**	**Rain / Snow**	**Departure**
Des Moines	Jul	76.0°F	-0.3°F	96°F (18th,19th)	51°F (28th)	1.02” / 0.0”	-3.45” / 0.0 “
	Aug	77.4°F	+3.1°F	104°F (30th)	57°F (14th,16th)	0.98” / 0.0”	-3.15” / 0.0”
	Sep	71.4°F	+5.8°F	101°F (9th)	47°F (21st,29th)	2.36” / 0.0”	-0.69” / 0.0”
	Oct	54.0°F	+0.9°F	86°F (2nd)	27°F (25th)	3.92” / 0.0”	+1.28” / 0.0”
Mason City	Jul	71.4°F	-0.4°F	93°F (18th)	47°F (28th,29th)	3.24” / 0.0”	-1.46” / 0.0”
	Aug	70.0°F	+0.7°F	93°F (26th,27th)	46°F (14th,15th)	2.26” / 0.0”	-1.78” / 0.0”
	Sep	64.9°F	+4.0°F	99°F (9th)	38°F (29th)	1.15” / 0.0”	-2.12” / 0.0”
	Oct	48.7°F	+0.5°F	81°F (2nd)	21°F (25th)	1.86” / 0.0”	-0.59” / 0.0”
Waterloo	Jul	72.6°F	-1.0°F	96°F (17th)	48°F (29th)	4.03” / 0.0”	-0.88” / 0.0”
	Aug	71.6°F	+0.4°F	95°F (30th)	47°F (14th)	2.00” / 0.0”	-2.27” / 0.0”
	Sep	65.8°F	+2.8°F	99°F (9th)	39°F (14th,29th)	1.48” / 0.0”	-1.15” / 0.0”
	Oct	49.6°F	-0.7°F	82°F (1st)	21°F (27th)	2.14” / 0.0”	-0.34” / 0.0”
Ottumwa	Jul	73.0°F	-2.0°F	97°F (19th)	48°F (28th)	1.44” / 0.0”	-3.03” / 0.0”
	Aug	73.4°F	+0.4°F	101°F (30th)	47°F (14th)	0.96” / M	-3.65” / M
	Sep	68.0°F	+3.6°F	98°F (9th)	41°F (29th)	1.07” / M	-2.72” / M
	Oct	52.7°F	+0.3°F	85°F (2nd)	23°F (27th)	4.38” / M	+1.55” / M

Fire Weather Season Wrap-Up *by Frank Boksa, Journey Forecaster*



The 2013 fire weather season officially ended for central Iowa on November 15. This means that fuels are now sufficiently cured or dried, such that a high fire risk in very dry and windy conditions can be assumed. Fuels are expected to remain in this state until spring. For those agencies planning burns, it can be assumed that in the absence of precipitation, fuels are dry and fire spread could be rapid.

The fire weather season was relatively uneventful compared to previous years. There was only one red flag warning issued on May 14, which was preceded by a fire weather watch on November 13. All counties in the red flag warning were verified. As of November 18, there were 104 spot fire requests filled. This number is lower than in previous years and was likely affected by the hot, dry end of summer and early fall and the government shut down in October, when we typically receive many spot fire requests for prescribed burns.

The forecasting of fire danger in our fire weather planning forecast requires information from several sources to retrieve the data necessary to make that forecast. The National Weather Service receives curing data information from satellite derived information and also voluntarily from County Conservation employees and an IDOT employee. I would like to extend a special thanks to those individuals who take the time to provide us with this information. Measuring how dry fuels are is a critical element in the calculation of fire danger and their information helps us to provide the best possible forecast of that.

The winter months will be spent evaluating the fire weather program and products and last season to see where improvements can be made.

Outlook for the winter of 2013-14 into the spring of 2014

by Miles Schumacher, Lead Forecaster

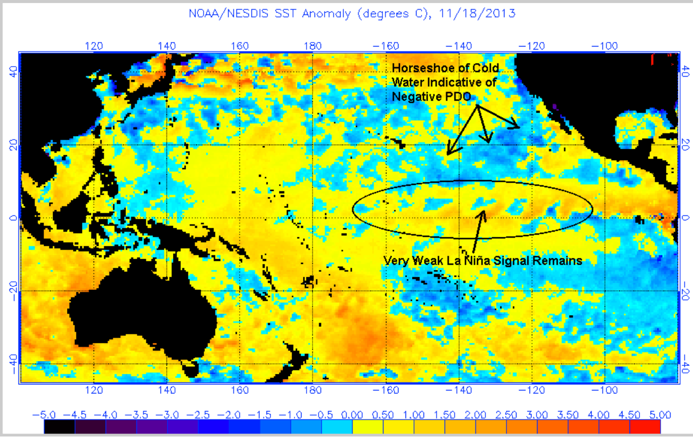


Figure 1: Sea surface temperature departure from normal, equatorial Pacific.

The summer of 2013 turned out to be a dry summer in many areas. Some parts of Iowa received less rainfall than the previous summer. It was significantly cooler this summer compared to the summer of 2012 however. The summer was expected to turn drier than normal. This is quite typical of the pattern we are presently in. During a cold Pacific Decadal Oscillation (PDO) it is more common to experience drought conditions, and after a significant drought year a "shadow" drought is common the following year. The fall season returned to more normal rainfall values with temperatures generally warmer than normal.

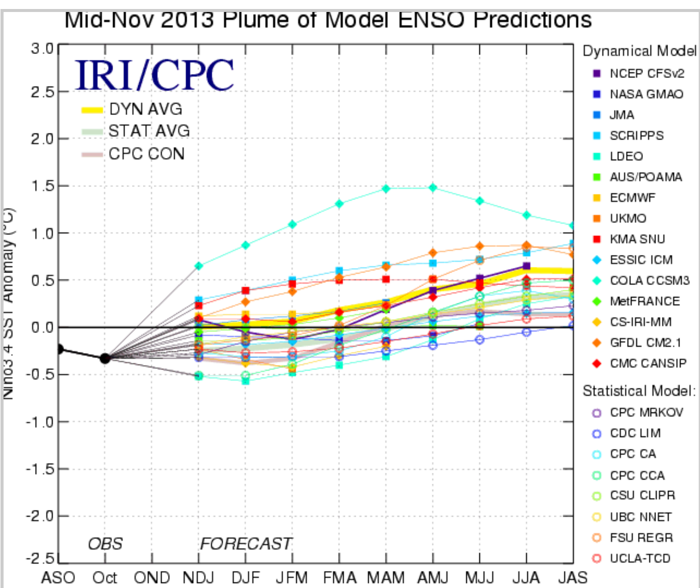


Figure 2: Sea surface temperature departure for the past 3-month season and for October are plotted in black. The projection extends from the November, December, and January 3-month period into the last summer of 2014. Departure in degrees Celsius is shown on the ordinate, with time on the abscissa.

The state of temperatures of the equatorial Pacific Ocean has generally remained in the neutral area, meaning the state was neither El Niño (warm) nor La Niña (cold). Temperatures have actually warmed somewhat over the past few months. The circled area in figure 1 shows the rather chaotic water temperature pattern. It is neither a clear La Niña nor El Niño event; though the patchy cool water over the eastern Pacific gives the pattern a slightly cool episode look. The PDO is still present as can be seen by the cooler than normal water extending from California southwest to the central Pacific south of Hawaii.

The atmosphere typically follows a three to seven year cycle between El Niño and La Niña. Depending on the phase of the PDO, El Niño/La Niña is favored during warm/cold phase of the PDO. The Pacific is currently in the cold phase of PDO. La Niña conditions are favored by a two to one margin during the cold phase. The pattern has been relatively cool for the past three years. The sea surface temperature (SST) departures were positive briefly about a year ago, however a full-blown El Niño failed to develop. Although we are likely to see the SST departures rise very slowly this winter into next summer, it is not likely that they will breakout into an El Niño pattern. This would be a typical occurrence, similar to what was observed during the last cold phase of the PDO, roughly from1947-1977. Model forecasts suggest the SST pattern across the equatorial Pacific is likely to remain close to neutral through next summer, though there is a steady warming forecast through the period. Figure 2 below shows the mean forecasts from several models of the Pacific SST departure. Several are dynamic models, others statistical. The average of each type is showed as broad lines, yellow and light green, with the Climate Prediction Center's consolidation shown in mauve. As can be seen figure 2, the most likely outcome through the next six months is a near normal, or neutral, state. To be either an El Niño or La Niña, the average temperature departure must be at least 0.5°C above or below normal, respectively, for three consecutive 90 day seasons.

Although in meteorology no two years are the same strictly speaking, one can look at weather patterns of the recent past to give some indications of near term weather trends in the future. This forecast is based in large part on the best fit from several of the years that were the most similar to the summer season just past. Considerations were also made for the state of the Pacific and expected near normal conditions, as well as other factors that influence our weather pattern. The Pacific SST's are not giving a strong signal for the winter into next summer.

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Outlook

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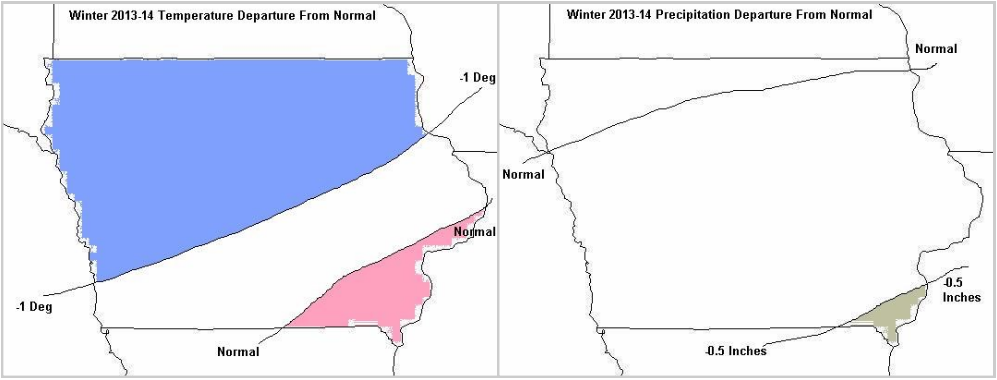

Figure 3: Mean temperature (left) and precipitation (right) departure for December of 2013 through February of 2014.

There are several factors to consider in addition to the statistical factors. This fall the snow extent over a large part of the Arctic is well above normal. This typically signals an enhanced probability for cold winters over central and eastern North America. At the same time, the solar cycle is approaching its secondary maximum of the current solar cycle. Similar to what occurred in the winter of 2001-02, this peak is occurring during the Boreal winter. That was one of the warmer winters in the record books. There are studies showing that during periods of high solar activity, the lower and middle levels of the atmosphere become warmer than normal. This of course would be a warm signal for the upcoming winter. The current solar cycle is much weaker than the one that occurred in 2001-02. For that reason, it would seem likely that the increase in Arctic snow cover would be more dominant, and was taken into account for the upcoming winter forecast.

The negative PDO pattern shown in figure 1 tends to result in the development of upper level low pressure off the west coast of the U.S. and a ridge over the southern or southeast U.S. This, in turn, allows Arctic air to stream south into the western U.S. more readily than in a more typical pattern. With the buildup of cold air in the Arctic this fall, it is expected there will be an ample pool of cold air to drop south into the U.S. Typically what happens with a pattern like this is that the cold will spill into the Plains, but it is not as strong of a push as if it moved directly south into the central U.S.

With this pattern there is a greater likelihood for more variability this winter with frequent changes from above to below normal temperatures. A lot will depend on where the storm track sets up; though at this time it appears that will be well south of Iowa. The cold air is likely to be poised just to the north of Iowa through much of the winter. Frequent incursions of cold air into the state will most likely result in below normal temperatures across the northwest. The weak ridge to the southeast of Iowa is expected to limit the southward penetration of the cold. The storm track is expected to be far enough southeast to limit heavy precipitation in the state. Rainfall is expected to be normal or a little below. See figure 3 for details.

Although the signals are relatively weak, temperatures this spring are expected to be fairly close to normal or slightly above normal though there is a tendency for the spring to start out cooler than normal. There is a statistical signal for the spring indicating the storm track is likely to remain south of normal for much of the spring. As a result, the heavier precipitation may well remain south of Iowa as well. Rainfall for the spring is expected to be a little below normal, tough extreme dryness is not likely. See figure 4 for details.

It will be important to monitor the oceanic and atmospheric patterns over the next several months, as well as when the solar cycle peaks. Although the signs point more toward cooler temperatures rather than warmer, changes in these would have a significant effect on expected winter temperatures.

These outlooks are based more heavily on statistics than many of the methods used by the [Climate Prediction Center](). The complete set of official forecasts from the Climate Prediction Center can be found on our [website]().

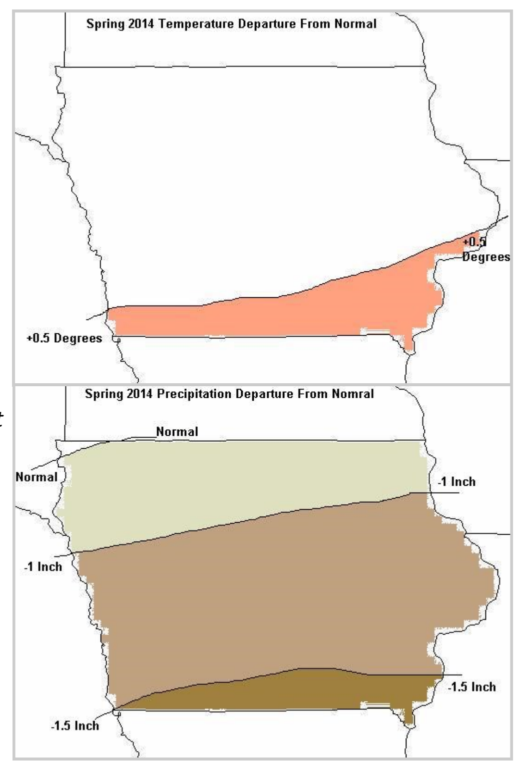

Figure 4: Mean temperature (top) and precipitation (bottom) departure forecast for the spring of 2014.

Utilizing High Resolution Satellite Imagery to Aid in a Tornado Damage Survey

by Kevin Skow, Meteorologist Intern

At the beginning of 2013, the NWS Central Region (CR) began partnering with the U.S. Geological Survey (USGS) in a pilot project, known as "Emergency Satellite Support," aimed at providing high resolution reconnaissance satellite imagery to local weather forecast offices (WFO) immediately following a high impact event. The WFO initiates the request with CR and CR forwards the information to the USGS, who will attempt to use a satellite that fits the criteria. Each request is usually fulfilled within a few days depending on satellite availability and cloud cover.

On the afternoon of June 12, 2013, a storm cell produced a series of tornadoes across north central Iowa, including one that struck the outskirts of the community of Belmond. Photographic and radar evidence, combined with near-storm environmental data, suggested that these tornadoes possessed many characteristics of landspouts. This made these tornadoes very unusual due to the cyclic nature of their development, along with their strength and longevity.

The following day, a team of experienced storm surveyors travelled from WFO Des Moines (DMX) to assess the damage. This was the third ground survey conducted by DMX using the newly implemented Damage Assessment Toolkit (DAT), and the second using the office's iPad. An off-duty television meteorologist also allowed the surveyors to use his personal remote-controlled quadcopter to capture low altitude aerial photos at several points along the damage track. At the end of the day, based on the observed damage and eyewitness accounts, the surveyors estimated that six tornadoes (1 EF3, 1 EF2, 2 EF1, and 2 EF0) occurred along a 25 mile stretch.

WFO Des Moines was one of the first CR offices to invoke the Emergency Satellite Support following the June 12 tornadoes, initiating the request on the morning after the event. The USGS photographed the affected area with the Worldview-2 satellite two meter panchromatic sensor. Other passes were made using the Worldview-2 multispectral sensor and additional satellites, but their resolution was sub-par compared to the panchromatic data and could not resolve the narrow damage paths. The imagery was subjectively compared to Google Maps background satellite imagery used in the DAT and the tracks traced out by hand in the DAT. This was necessitated due to both the huge file size of the GeoTIFF files (500-900mb) and the inability for the DAT to import any external shapefile/kml file. Ideally, it would have been great to import the satellite data into the DAT to trace out the tracks. As an added benefit, comparing the pre-event satellite imagery in Google Maps to the post-event imagery helped filter out any features (natural or anthropogenic) that could be mistaken for a tornado tracks.

The satellite data proved extremely valuable in piecing together the tracks of the original three tornadoes noted by the ground survey. The DAT-screen captures show the tornado tracks published on the day following the ground survey, before the satellite imagery was available. Tornado #1 was the strongest of the tornadoes (EF3) and also garnered the most media attention since it damaged the northern and eastern outskirts of Belmond. Tornado #2 was a brief touchdown west of Belmond witnessed by law enforcement. Finally, Tornado #3 formed to the east of Belmond and tracked southeast for several miles before dissipating.

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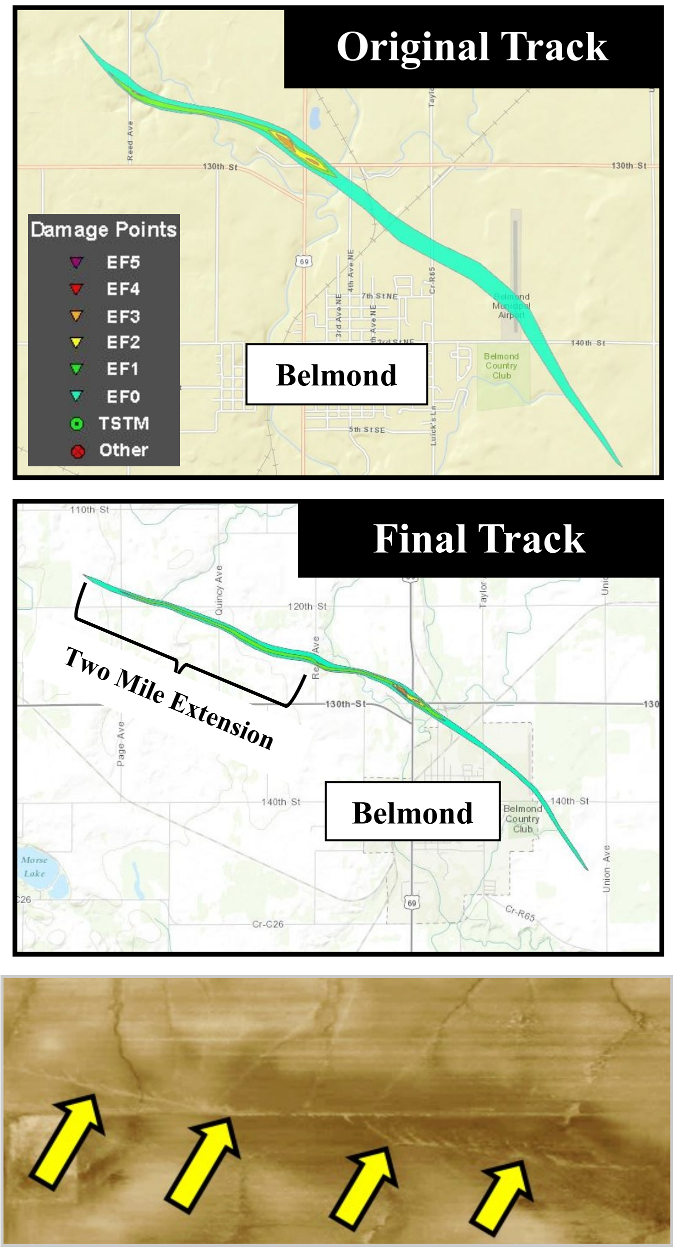

Figure 1: *Original tornado track as determined by ground survey crew (top) compared to final track as determined using satellite data (middle). An example of the satellite data (bottom) with the extended track noted by yellow arrows.*

High Resolution Satellite Imagery

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Tornado #1
The survey team originally plotted the beginning of Tornado #1 at a location two miles northwest of Belmond based on an eyewitness report of the touchdown. The narrow damage field at this location, coupled with aerial photos from the quadcopter also showing a narrow path beginning in the nearby field, lent credibility to this report. However, satellite data revealed distinct swirls extending to the west-northwest (yellow arrows in figure 1) for another two miles beyond the original start location. Given the slow movement of the tornado, this two mile extension pulled the start time back by eight minutes. The remainder of the track of Tornado #1 was well-documented by the survey team and only minimal changes were made based on the satellite data.

Tornado #2
Tornado #2 was reported to have briefly touched down in a field to the south of Tornado #1 as it was approaching Belmond. The survey team found no damage in the area but noted this tornado in the preliminary write-up. Satellite data revealed no field scouring in this area. This, combined with the updated position of "Tornado #3" as a result of the satellite data (see section below), provided strong evidence that the eyewitness was watching the development of the latter tornado, thus Tornado #2 was the same as Tornado #3. The tornado was stricken from the record after reviewing the satellite data and additional video evidence.

Tornado #3
As the survey team travelled to the east of Belmond, they were initially unable to find any evidence of a track. It did not take long, however, before the team ran across a scoured field less than two miles east-southeast of Belmond. Given the relatively close proximity of this track to the last known damage point on the east side of Belmond and the fact that it was on the same trajectory as the previous path, the team naturally connected these two points into a single track. But the idea of a singular track faded quickly the day following the survey when the office received a video that clearly showed Tornado #1 dissipating just east of Belmond, indicating that these were two separate tornado tracks. Thus, the beginning location for "Tornado #3" (officially now Tornado #2) was plotted just to the northwest of where the survey team first located a track to the east of where Tornado #1 dissipated.

A careful analysis of the satellite imagery revealed that this tornado actually touched down on the eastern side of Belmond, two miles to the west-northwest of its estimated start location. It was here that a mesonet weather station on the Belmond Elementary School was blown off the roof. This damage had been initially attributed to a rear flank downdraft-like wind with Tornado #1 tracking 1000 yards to the northeast. No other damage was noted to any trees or structures surrounding the school. However, just 500 feet to the north of the county road leading east out of Belmond, faint, intermittent swirls can be found in the satellite imagery along an east-northeast path that can be traced directly back to the school. This circulation becomes more pronounced after crossing the city airstrip and then turns to the east and southeast before meeting up with surveyed track. This extended track also crosses the path of Tornado #1 at the Belmond airstrip (figure 3, yellow arrows denote Tornado #1, red arrows denote Tornado #3). A video obtained after reviewing the satellite imagery shows that Tornado #3 formed on the east side of Belmond as Tornado #1 was entering the north side of down. Tornado #3 then progressed to the east and southeast while Tornado #1 turned southeast and crossed its path ten minutes later. While the video helped determine the timing of the tornadoes, it was shot from a long distance away and would not have aided in plotting the track location.

Overall, this event was a successful demonstration in the usage of satellite data to locate tornado tracks. The traditional ground survey is still needed to ascertain an accurate rating of a tornado, but satellite imagery helps fill in the voids that ground surveyors may miss due to poor road networks or a lack of time. It stands alongside photo, video, and eyewitness accounts as a means to accurately document a tornado. This was a

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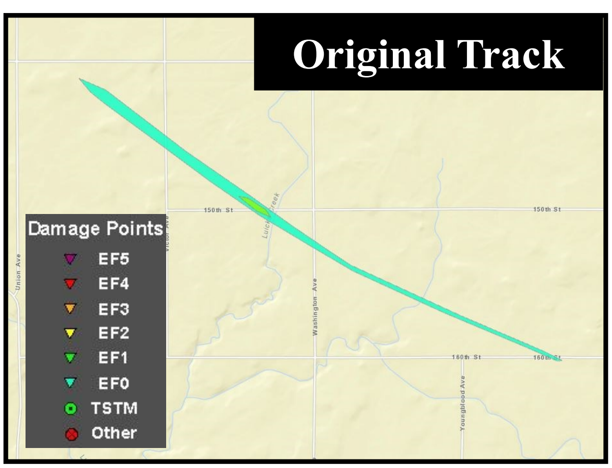
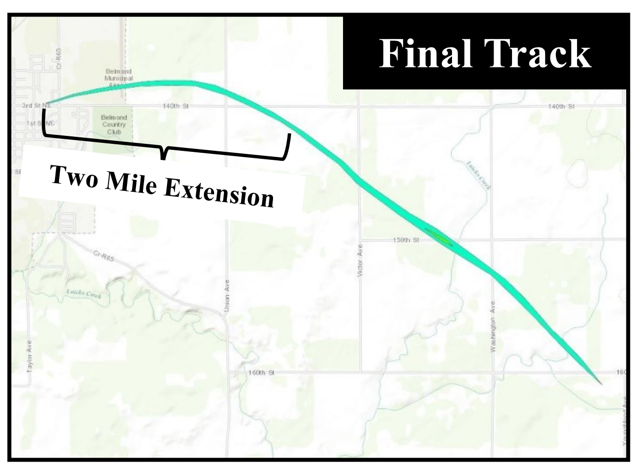


Figure 2: *Original track of tornado #3 as determined by ground survey crew (left) compared to final track as determined using satellite data (right).*



High Resolution Satellite Imagery

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relatively small and confined tornado event, but for an expansive tornado outbreak, satellite data could become invaluable for locating smaller tornadoes which might be missed on a ground survey. Combined with the DAT, this imagery enabled DMX to create incredibly high resolution tornado tracks for archiving in Storm Data.

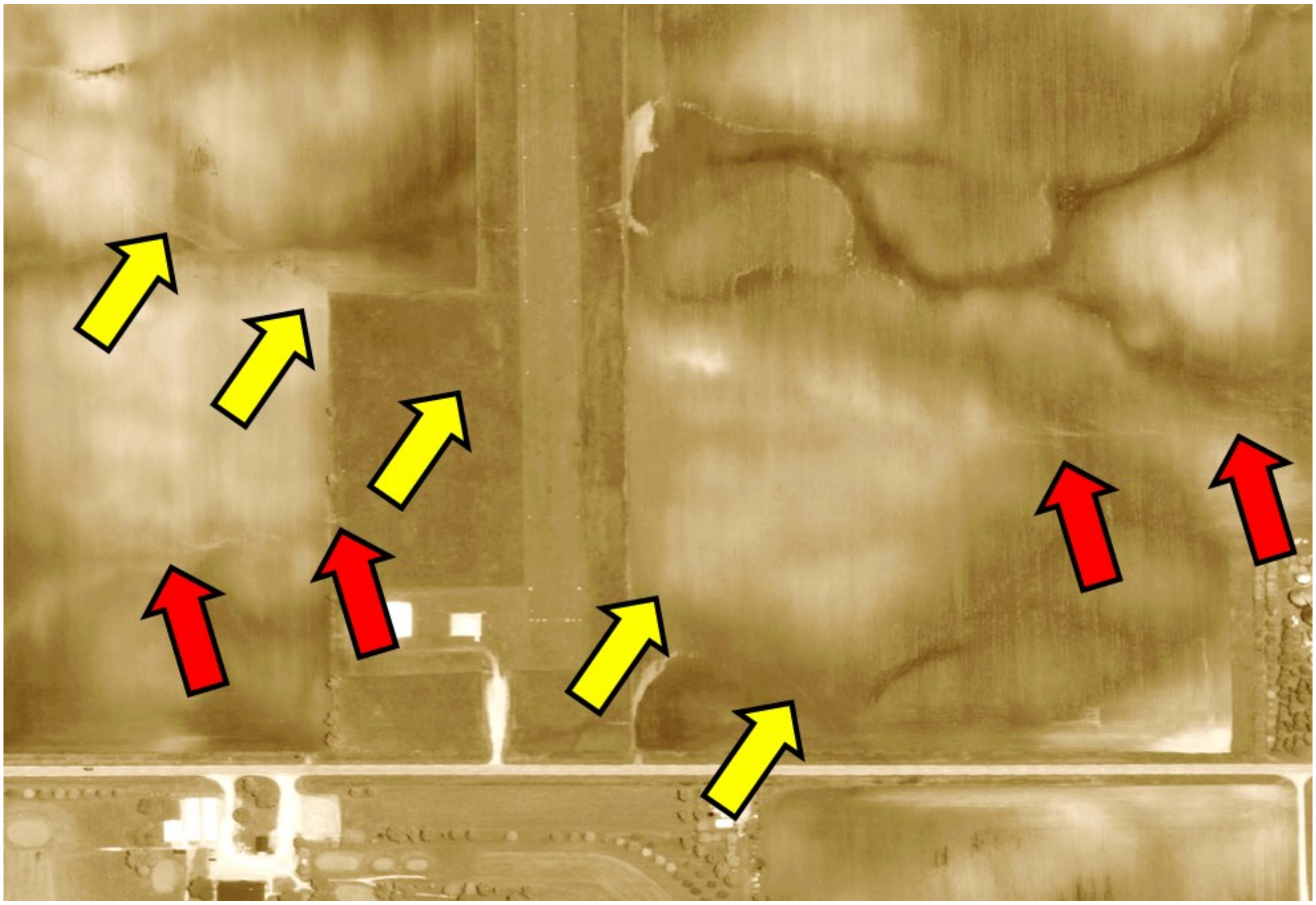

Figure 4: *Satellite imagery showing the crossing tracks of Tornado #1 (yellow arrows) and Tornado #3 (red arrows). The tornadoes' paths crossed near the Belmond airstrip.*

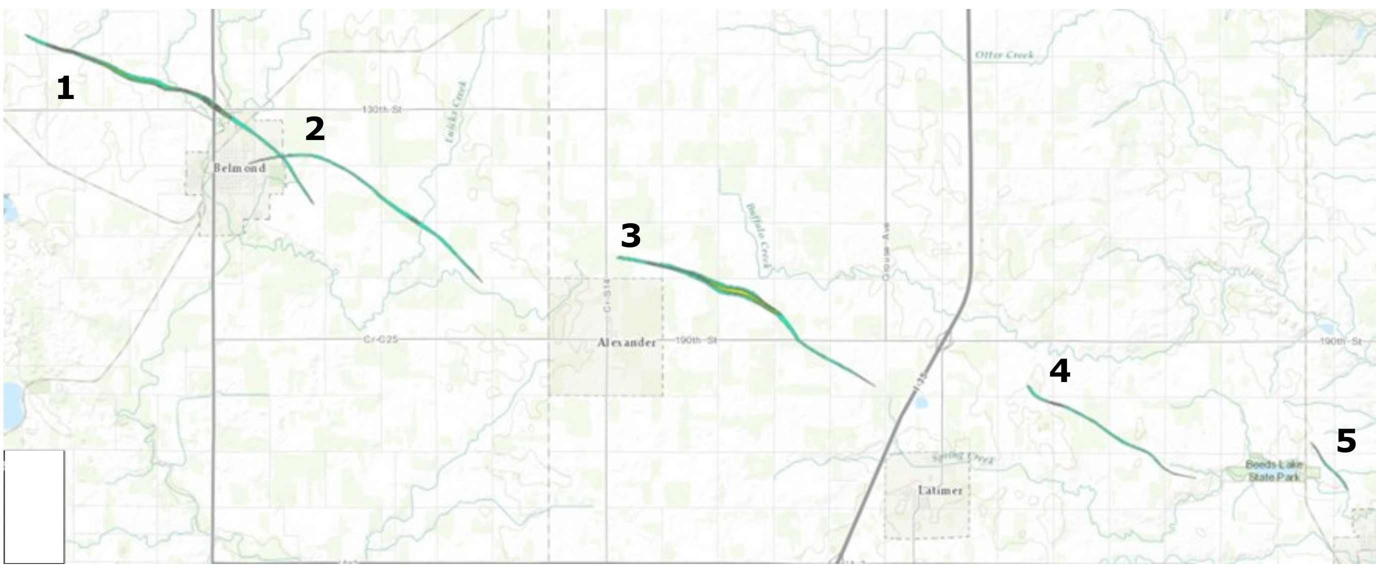

Figure 5: *The final tornado tracks determined for the June 12, 2013 event as viewed in the DAT software. Note that the number of tornadoes decreased from six to five after review of the satellite data.*

Clouds

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